MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) M270A1 LAUNCHER

Army ACAT IC Program		**Prime Contractor**
Total Number of Systems:	857	Lockheed Martin Vought Systems
Total Program Cost (TY$):	$2,297.7M	
Average Unit Cost (TY$):	$2.437M	
Full-rate production:	1QFY02	

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The Multiple Launch Rocket System (MLRS) provides the Army with a non-nuclear, all-weather, indirect, area fire weapon system to strike counterfire, air defense, armored formations, and other high-payoff targets at all depths of the tactical battlefield. Primary missions of MLRS include the suppression, neutralization, and destruction of threat fire support and forward area air defense targets. The MLRS M270 Launcher is the standard U.S. Army platform for firing surface-to-surface artillery rockets and missiles. M270A1 improvements are intended to enhance the field artillery's support to armor and infantry units to reinforce the ***dominant maneuver*** force by improving the corps commander's ***precision engagement*** capabilities for shaping the battlespace at extended ranges.

MLRS consists of a self-loading launcher with an onboard fire control system. The launcher is mounted on a mobile track vehicle that carries 12 rockets or 2 Army Tactical Missile System (Army TACMS) missiles that can be fired individually or sequentially. Rockets have a range beyond 30 kilometers, and the Army TACMS Block IA missile can reach beyond 300 kilometers.

The M270A1 program includes two major upgrades to the current M270 launcher. First is the Improved Fire Control System (IFCS), which replaces obsolete, maintenance-intensive hardware and software, providing growth potential for future munitions and the potential for reduced launcher operation and support costs. IFCS includes a Global Positioning System-aided navigation system for the launcher to supplement the existing inertial position-navigation system. Second, the Improved Launcher Mechanical System (ILMS) is designed to improve reaction times by decreasing the time to aim and load the launcher. This is achieved by providing a faster launcher drive system that moves simultaneously in azimuth and elevation. ILMS is expected to reduce the traverse time from the stowed position to worst case aimpoint by approximately 80 percent. It should also decrease the mechanical system contribution to reload time by about 40 percent. The reduction in time spent at the launch and reload points is expected to increase ***full-dimensional protection***. In addition to the IFCS and ILMS modifications, the M270A1 program includes the remanufacture of selected components and the application of selected Engineering Change Proposals to the basic M270 launcher, bringing all launchers to the same configuration.

BACKGROUND INFORMATION

MLRS initial operational capability occurred in 1983. To combat the system's growing obsolescence, the Army initiated the IFCS program with a Milestone II in 4QFY92. Additionally, analysis following Operation Desert Storm identified a requirement for faster prosecution of highly mobile, short dwell targets by the M270 Launcher. The ILMS program began in 4QFY95.

Until FY96, IFCS and ILMS were managed by the Army as separate Acquisition Category III programs with separate TEMPs. In November 1995, the Army submitted the IFCS TEMP. That TEMP was returned by DOT&E so that the Army could integrate ILMS into a combined M270A1 TEMP, include a side-by-side operational test, and include more firings in a DT/OT program. DOT&E approved the M270A1 TEMP in November 1996. The resulting MLRS program restructure kept IFCS and ILMS modifications as two separate program elements through ILMS system integration. At that time, the test programs were combined under the M270A1 to undergo IOT&E. IOT&E is now scheduled to occur in 3QFY01.

On May 28, 1998, the Program Executive Officer Tactical Missiles approved low rate initial production of IFCS and ILMS hardware modification kits for integration into the M270A1 to support a first unit-equipped date in 4QFY00.

At the end of FY98, the program decided to replace the 486-based executive processor with a Power PC processor, and the proprietary operation system with the commercial VxWorks operating system after 1999 IOT&E, but prior to the first unit equipped. A series of developmental tests, including an Extended System Integration Test (ESIT) on the modified system (to verify that the changes do not adversely affect launcher performance) were planned but have since been abandoned.

TEST & EVALUATION ACTIVITY

In January 1999, the M270A1 completed system integration tests, which included firing each of the currently fielded MLRS Family of Munitions.

The M270A1 ESIT ground phase was conducted in January-March 1999 at Ft. Sill, OK. It included a position navigation unit test and two four-day field exercises for one M270A1 and one baseline M270 launcher.

The M270A1 ESIT flight phase (an operational test event to demonstrate that M270A1 does not degrade MLRS Family of Munitions effectiveness) began in April. The flight phase was terminated in June after continued problems in firing multiple rockets. M270A1 executed four of nine rocket missions, and one each Army TACMS Block I and Block IA missions. However, an in-flight detonation of the Block IA left that mission unfinished. Additionally, termination of the test flight phase left two extended range rocket and three basic rocket missions undone.

The 1QFY99 Logistics Demonstration identified that software and Built-in Test/Built-in Test Equipment (BIT/BITE) are keys to a successful M270A1 logistics system. The initial IFCS Maintainability Demonstration, December 1998-January 1999, was suspended by the Government due to poor results. The demonstration resumed in May 1999.

At the end of July, the Army slipped IOT&E 22 months to allow the program time to fix problems identified in the ESIT and Maintainability Demonstration, and to include planned replacement of the executive processors and IFCS operating system. In October, the program manager submitted a new Acquisition Program Baseline that scheduled the IOT&E ground phase in May 2001 followed by the OT flight phase in June. The Milestone III review will be in 1QFY02.

In place of the postponed August IOT&E, the program conducted a Customer Test that included a 72-hour field exercise for one platoon of M270A1 launchers side-by-side with a platoon of M270 launchers.

The Army conducted an MLRS survivability program to complete survivability estimates of the M270A1, determine the effects of M270A1 improvements on the survivability of the fielded launcher, and develop recommended changes to M270A1 and MLRS tactics to enhance launcher and crew survivability. The Aberdeen Test Center completed blast and shock tests in 1997 and payload sensitivity tests in 4QFY98. The Army Research Laboratory, Survivability/Lethality Analysis Directorate completed component experiments in 1998 and a vulnerability analysis in 1999.

TEST & EVALUATION ASSESSMENT

IFCS software problems have plagued M270A1 throughout the program's life even though the IFCS software formal qualification test demonstrated ballistic solutions as accurate as the current fire control system (FCS version 6.06). The IFCS development contract was extended nine months through September 1998 for the contractor to demonstrate improved software robustness and maturity. Lack of software maturity continued in ESIT, causing the crew to reboot the system frequently (approximately every 3.5 hours). The Bravo 2 version of software introduced just before the flight phase began was released before Test and Evaluation Command verification of regression test results had been completed. Additional software releases were required after the ESIT flight phase began. As of the IOT&E postponement, at least two priority level two and several hundred lower level software trouble reports remain open.

ESIT and Customer Test results indicate inadequate system performance in other areas. Inconsistent communications between the Fire Direction System and M270A1 launcher resulted in a low mission transmission success rate that coupled with launcher problems to produce a low fire mission completion rate. Launchers continued to have problems during the Customer Test, which forced at least one crew to reconfigure communications frequently. Additionally, M270A1 crews participating in the Customer Test had to employ an extensive list of workarounds for software problems. Although the launcher did not meet requirements for all mission execution timelines, M270A1 mission times from stowed position to first round fired were 35-80 percent better than the basic M270 launcher times.

ESIT flight tests failed to demonstrate the launcher's ability to execute consistent ripple firing of multiple rockets. However, after a modification of the resolver card, the M270A1 launcher successfully executed 2-, 3-, 5-, and 6-rocket missions in the Customer Test. Rocket flight tests have not yet demonstrated required accuracy, possibly due to winds along the trajectory.

Maintenance Demonstration results indicate inadequate BIT/BITE performance. M270A1 has shown the capability to detect and isolate a problem to the line replaceable unit level of approximately 60 percent for IFCS and 70 percent for ILMS against a statement of work requirement of 95 percent.

A number of system vulnerabilities were found in the survivability program. Some can be corrected with minor engineering changes to such components as the fuel filter bracket and radiator cover to reduce the vulnerability of the system to "cheap" automotive kills. Others, however, are more significant, and their correction will entail additional armor protection to lessen the likelihood of payload initiation.

DOT&E will actively participate in developing a new TEMP following continued developmental testing and observing M270A1 IOT&E in 2001. DOT&E will also prepare its own evaluation of the M270A1 to support the full-rate production decision in 1QFY02.

CONCLUSIONS, RECOMMENDATIONS, LESSONS LEARNED

The Army has slipped IOT&E 22 months in the last several months primarily due to software problems. Even though IFCS software development was primarily the conversion of existing logic from JOVIAL to Ada, the program experienced serious integration, robustness, and maturity problems. Software development was hampered by problems that included contractor staffing shortages, lack of experienced Ada programmers, and late requirements development. All software development programs, no matter how trivial they may seem, require intensive oversight and management.

The changing M270A1 configuration during the ESIT flight phase demonstrated that LRIP articles should be used during IOT&Es whenever possible. The M270A1 T&E Strategy should be modified to provide LRIP launchers for the M270A1 platoon in IOT&E, with a rigorous software entrance criteria established.

The operational test flight phase must be reconducted after hardware and software configurations have been frozen.

The Program Manager has provided funding to the Army Research Laboratory to investigate possible ways to improve the armor for the MLRS Launcher Loader Module to inhibit a payload reaction from enemy fire. When a satisfactory solution is developed, it should be applied to all MLRS launchers. At the same time, the Army should correct some potential chassis-related vulnerabilities discovered during the LFT&E of the Command and Control Vehicle, which uses a modified MLRS chassis.

Operation Desert Storm first identified the critical need for faster prosecution of highly mobile, short-dwell-time targets by MLRS launchers. Emerging North Korean tactics have further highlighted the importance of reducing M270 reaction times. Although software immaturity and reliability problems found in the Customer Test showed further development is warranted, launcher fire mission performance indicated that the M270A1 would significantly reduce MLRS reaction times, hence improving the Army's ability to engage short-dwell targets.